Unit

15

POLYMERS

I. Multiple Choice Questions (Type-I)

1. Which of the following polymers of glucose is stored by animals?

(i) Cellulose

(ii) Amylose

(iii) Amylopectin

(iv) Glycogen

2. Which of the following is **not** a semisynthetic polymer?

(i) *cis*-polyisoprene

(ii) Cellulose nitrate

(iii) Cellulose acetate

(iv) Vulcanised rubber

3. The commercial name of polyacrylonitrile is _____.

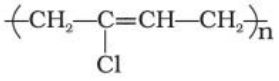
(i) Dacron

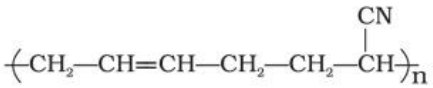
(ii) Orlon (acrilan)

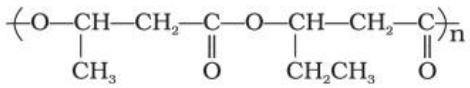
(iii) PVC

(iv) Bakelite

4. Which of the following polymer is biodegradable?

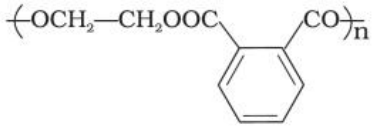
(i) 

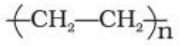
(ii) 

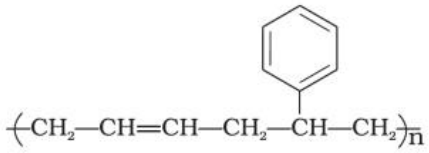
(iii) 

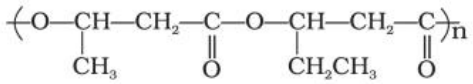
(iv) 

5. In which of the following polymers ethylene glycol is one of the monomer units?

(i) 

(ii) 

(iii) 

(iv) 

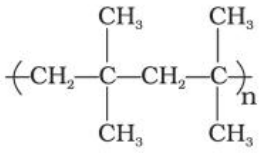
6. Which of the following statements is **not** true about low density polythene?

(i) Tough

(ii) Hard

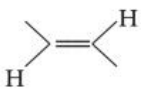
(iii) Poor conductor of electricity

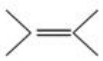
(iv) Highly branched structure

7.  is a polymer having monomer units _____.

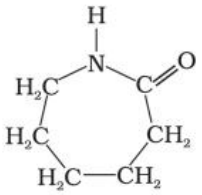
(i) 

(ii) 

(iii) 

(iv) 

8. Which of the following polymer can be formed by using the following monomer unit?



(i) Nylon 6, 6
(ii) Nylon 2–nylon 6
(iii) Melamine polymer
(iv) Nylon-6

II. Multiple Choice Questions (Type-II)

Note : In the following questions two or more options may be correct.

9. Which of the following polymers, need atleast one diene monomer for their preparation?
(i) Dacron
(ii) Buna-S
(iii) Neoprene
(iv) Novolac

10. Which of the folloiwng are characteristics of thermosetting polymers?
(i) Heavily branched cross linked polymers.
(ii) Linear slightly branched long chain molecules.
(iii) Become infusible on moulding so cannot be reused.
(iv) Soften on heating and harden on cooling, can be reused.

11. Which of the following polymers are thermoplastic?
(i) Teflon
(ii) Natural rubber
(iii) Neoprene
(iv) Polystyrene

12. Which of the following polymers are used as fibre?
(i) Polytetrafluoroethane
(ii) Polychloroprene
(iii) Nylon
(iv) Terylene

13. Which of the following are addition polymers?

(i) Nylon

(ii) Melamine formaldehyde resin

(iii) Orlon

(iv) Polystyrene

14. Which of the following polymers are condensation polymers?

(i) Bakelite

(ii) Teflon

(iii) Butyl rubber

(iv) Melamine formaldehyde resin

15. Which of the following monomers form biodegradable polymers?

(i) 3-hydroxybutanoic acid + 3-hydroxypentanoic acid

(ii) Glycine + amino caproic acid

(iii) Ethylene glycol + phthalic acid

(iv) Caprolactum

16. Which of the following are example of synthetic rubber?

(i) Polychloroprene

(ii) Polyacrylonitrile

(iii) Buna-N

(iv) *cis*-polyisoprene

17. Which of the following polymers can have strong intermolecular forces?

(i) Nylon

(ii) Polystyrene

(iii) Rubber

(iv) Polyesters

18. Which of the following polymers have vinylic monomer units?

(i) Acrilan

(ii) Polystyrene

(iii) Nylon

(iv) Teflon

19. Vulcanisation makes rubber _____.

(i) more elastic

(ii) soluble in inorganic solvent

(iii) crystalline

(iv) more stiff

III. Short Answer Type

20. A natural linear polymer of 2-methyl-1, 3-butadiene becomes hard on treatment with sulphur between 373 to 415 K and —S—S— bonds are formed between chains. Write the structure of the product of this treatment?

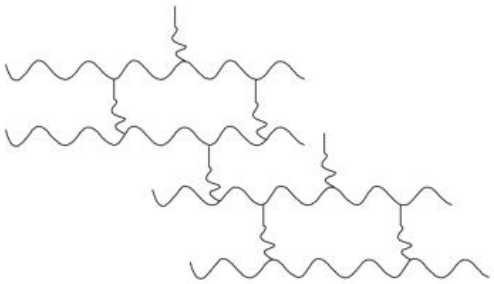
21. Identify the type of polymer.
—A—A—A—A—A—A—

22. Identify the type of polymer.
—A—B—B—A—A—A—B—A—

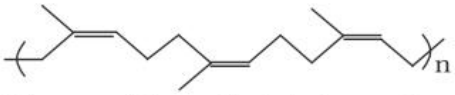
23. Out of chain growth polymerisation and step growth polymerisation, in which type will you place the following.

$$\text{-(A)-}_m + \text{-(A)-}_n \longrightarrow \text{-(A)-(A)-}_{m\ n} \text{ or } \text{-(A—A)-}_{m+n}$$

24. Identify the type of polymer given in the following figure.



25. Identify the polymer given below :

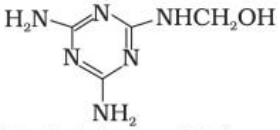


26. Why are rubbers called elastomers?

27. Can enzyme be called a polymer?

28. Can nucleic acids, proteins and starch be considered as step growth polymers?

29. How is the following resin intermediate prepared and which polymer is formed by this monomer unit?



(Resin intermediate)

30. To have practical applications why are cross links required in rubber?

31. Why does *cis*-polyisoprene possess elastic property?

32. What is the structural difference between HDP and LDP? How does the structure account for different behaviour and nature, hence the use of a polymer?

33. What is the role of benzoyl peroxide in addition polymerisation of alkenes? Explain its mode of action with the help of an example.

34. Which factor imparts crystalline nature to a polymer like nylon?

35. Name the polymers used in laminated sheets and give the name of monomeric units involved in its formation.

36. Which type of biomolecules have some structural similarity with synthetic polyamides? What is this similarity?

37. Why should the monomers used in addition polymerisation through free radical pathway be very pure?

IV. Matching Type

Note : Match the items of Column I with the items in Column II.

38. Match the polymer of column I with correct monomer of column II.

	Column I		**Column II**
(i)	High density polythene	(a)	Isoprene
(ii)	Neoprene	(b)	Tetrafluoroethene
(iii)	Natural rubber	(c)	Chloroprene
(iv)	Teflon	(d)	Acrylonitrile
(v)	Acrilan	(e)	Ethene

39. Match the polymers given in Column I with their chemical names given in Column II.

	Column I		**Column II**
(i)	Nylon 6	(a)	Polyvinyl chloride
(ii)	PVC	(b)	Polyacrylonitrile
(iii)	Acrilan	(c)	Polycaprolactum
(iv)	Natural rubber	(d)	Low density polythene
(v)	LDP	(e)	*cis*-polyisoprene

40. Match the polymers given in Column I with their commercial names given in Column II.

	Column I		**Column II**
(i)	Polyester of glycol and phthalic acid	(a)	Novolac
(ii)	Copolymer of 1, 3-butadiene and styrene	(b)	Glyptal
(iii)	Phenol and formaldehyde resin	(c)	Buna-S

(iv)	Polyester of glycol and terephthalic acid	(d)	Buna-N
(v)	Copolymer of 1, 3-butadiene and acrylonitrile	(e)	Dacron

41. Match the polymers given in Column I with their main applications given in Column II.

	Column I		**Column II**
(i)	Bakelite	(a)	Unbreakable crockery
(ii)	Low density polythene	(b)	Non-stick cookwares
(iii)	Melamine-formaldehyde resin	(c)	Packaging material for shock absorbance
(iv)	Nylon 6	(d)	Electrical switches
(v)	Polytetrafluoroethane	(e)	Squeeze bottles
(vi)	Polystyrene	(f)	Tyre, cords

42. Match the polymers given in Column I with the preferred mode of polymerisation followed by their monomers.

	Column I		**Column II**
(i)	Nylon-6,6	(a)	Free radical polymerisation
(ii)	PVC	(b)	Ziegler-Natta polymerisation or coordination polymerisation
(iii)	HDP	(c)	Anionic polymerisation
		(d)	Condensation polymerisation

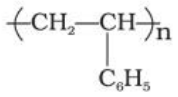
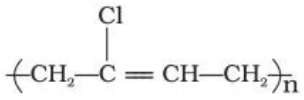
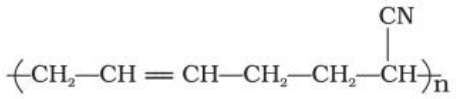
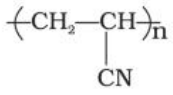
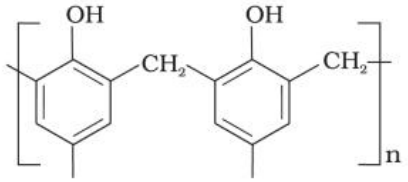
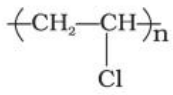
43. Match the polymers given in Column I with the type of linkage present in them given in Column II.

	Column I		**Column II**
(i)	Terylene	(a)	Glycosidic linkage
(ii)	Nylon	(b)	Ester linkage
(iii)	Cellulose	(c)	Phosphodiester linkage
(iv)	Protein	(d)	Amide linkage
(v)	RNA		

44. Match materials given in Column I with the polymers given in Column II.

	Column I		**Column II**
(i)	Natural rubber latex	(a)	Nylon
(ii)	Wood laminates	(b)	Neoprene
(iii)	Ropes and fibres	(c)	Dacron
(iv)	Polyester fabric	(d)	Melamine formaldehyde resins
(v)	Synthetic rubber	(e)	Urea-formaldehyde resins
(vi)	Unbreakable crockery	(f)	cis-polyisoprene

45. Match the polymers given in Column I with their repeating units given in Column II.

Column I		**Column II**	
(i)	Acrilan	(a)	
(ii)	Polystyrene	(b)	
(iii)	Neoprene	(c)	
(iv)	Novolac	(d)	
(v)	Buna—N	(e)	
		(f)	

V. Assertion and Reason Type

Note : In the following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

(i) Assertion and reason both are correct statement but reason does not explain assertion.

(ii) Assertion and reason both are correct statements and reason explains the assertion.

(iii) Both assertion and reason are wrong statement.

(iv) Assertion is correct statement and reason is wrong statement.

(v) Assertion is wrong statement and reason is correct statement.

46. **Assertion** : Rayon is a semi synthetic polymer and is taken as a better choice than cotton fabric.

Reason : Mechanical and aesthetic properties of cellulose can be improved by acetylation.

47. **Assertion** : Most of the Synthetic polymers are not biodegradable.
Reason : Polymerisation process induces toxic character in organic molecules.

48. **Assertion** : Olefinic monomers undergo addition polymerisation.
Reason : Polymerisation of vinylchloride is initiated by peroxides/ persulphates.

49. **Assertion** : Polyamides are best used as fibres because of high tensile strength.
Reason : Strong intermolecular forces (like hydrogen bonding within polyamides) lead to close packing of chains and increase the crystalline character, hence, provide high tensile strength to polymers.

50. **Assertion** : For making rubber synthetically, isoprene molecules are polymerised.
Reason : Neoprene (a polymer of chloroprene) is a synthetic rubber.

51. **Assertion** : Network polymers are thermosetting.
Reason : Network polymers have high molecular mass.

52. **Assertion** : Polytetrafluoroethene is used in making non-stick cookwares.
Reason : Fluorine has highest electronegativity.

VI. Long Answer Type

53. Synthetic polymers do not degrade in the environment for a long time. How can biodegradable synthetic polymers be made. Differentiate between biopolymers and biodegradable polymers and give examples of each type.

54. Differentiate between rubbers and plastics on the basis of intermolecular forces.

55. Phenol and formaldehyde undergo condensation to give a polymar (A) which on heating with formaldehyde gives a thermosetting polymer (B). Name the polymers. Write the reactions involved in the formation of (A). What is the structural difference between two polymers?

56. Low density polythene and high density polythene, both are polymers of ethene but there is marked difference in their properties. Explain.

57. Which of the following polymers soften on heating and harden on cooling? What are the polymers with this property collectively called? What are the structural similarities between such polymers? Bakelite, urea-formaldehyde resin, polythene, polyvinyls, polystyrene.

ANSWERS

I. Multiple Choice Questions (Type-I)

1. (iv) 2. (i) 3. (ii) 4. (iv) 5. (i) 6. (iii)
7. (i) 8. (iv)

II. Multiple Choice Questions (Type-II)

9. (ii), (iii) 10. (i), (iii) 11. (i), (iv) 12. (iii), (iv)

13. (iii), (iv) 14. (i), (iv) 15. (i), (ii) 16. (i), (iii)

17. (i), (iv) 18. (i), (ii), (iv) 19. (i), (iv)

III. Short Answer Type

20. Vulcanised rubber. For structure see Class XII NCERT textbook.

21. Homopolymer

22. Copolymer

23. Chain growth polymerisation

24. Cross-linked polymer

25. Polyisoprene/Natural rubber

26. Rubbers are stretched on application of force and regain original state after the force is removed. Therefore these are called elastomers.

27. Enzymes are biocatalysts which are proteins and are thus polymers.

28. [**Hint :** Yes, step growth polymers are condensation polymers and they are formed by the loss of simple molecule like water leading to the formation of high molecular mass polymers.]

29. Melamine and formaldehyde are starting materials for this intermediate. Its polymerisation gives melamine polymer.

30. Cross links bind the planar polymer sheets thus increasing its elastomeric properties.

31. See Class XII, NCERT text book, page no.434.

32. See Class-XII NCERT textbook, page no. 429-30.

33. See Class-XII NCERT textbook, page no. 428.

34. Strong intermolecular forces like hydrogen-bonding, lead to close packing of chains that imparts crystalline character.

35. Urea formaldehyde resins. Monomer units are urea and formaldehyde.

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36. Proteins. Polyamides and proteins both contain amide linkage.

37. Pure monomers are required because even the traces of impurities may act like inhibitors which leads to the formation of polymers with shorter chain length.

IV. Matching Type

38. (i) → (e) (ii) → (c) (iii) → (a) (iv) → (b) (v) → (d)

39. (i) → (c) (ii) → (a) (iii) → (b) (iv) → (e) (v) → (d)

40. (i) → (b) (ii) → (c) (iii) → (a) (iv) → (e) (v) → (d)

41. (i) → (d) (ii) → (e) (iii) → (a) (iv) → (f) (v) → (b) (vi) → (c)

42. (i) → (d) (ii) → (a) (iii) → (b)

43. (i) → (b) (ii) → (d) (iii) → (a) (iv) → (d) (v) → (c)

44. (i) → (f) (ii) → (e) (iii) → (a) (iv) → (c) (v) → (b) (vi) → (d)

45. (i) → (d) (ii) → (a) (iii) → (b) (iv) → (e) (v) → (c)

V. Assertion and Reason Type

46. (ii) 47. (iv) 48. (i) 49. (ii) 50. (v) 51. (i)

52. (i)

VI. Long Answer Type

53. See NCERT textbook for Class XII.

54. See NCERT textbook for Class XII.

55. 'A' is novolac, 'B' is bakelite.

56. **Hint :** Low density and high density polythenes are obtained under different conditions. These differ in their structural features. Low density polythenes are highly branched structures while high density polythene consists of closely packed linear molecules. Close packing increases the density.

57. **Hint :** Polythene, polyvinyls and polystyrene soften on heating and harden on cooling. Such polymers are called thermoplastic polymers. These polymers are linear or slightly branched long chain molecules. These possess intermolecular forces whose strength lies between strength of intermolecular forces of elastomers and fibres.